Abstract:


Particle Access and Charging Environments in the Lunar Wake

A plasma wake — a region of low density, high temperature plasma — forms on the far side of the Moon when solar wind, magnetosheath, and magnetotail plasma flows past the Moon [*Manka*, 1973; *Ogilvie et al*., 1996; *Farrell et al.*, 1998; *Halekas et al*., 2005]. Ion populations in these flows typically have much smaller thermal velocity than bulk speed and are therefore excluded from the plasma wake while the large thermal electron velocity allows the lighter negatively charged particles to stream ahead of the ions into the wake. Charge separation due to electrons streaming ahead of the ions into the wake from the wake boundary establishes an ambipolar electric field which impedes the motion of electron flow and accelerates ions into the wake [*Ogilvie et al., 1996*; *Farrell et al.*, 1997].

We have conducted a theoretical study of acceleration (and deceleration) of charged particles in lunar plasma environments, which investigated the mechanisms responsible for allowing solar wind entry into the lunar wake, and for producing energetic particle distributions observed within the lunar wake. To this end, the investigation utilized a macroscale 3D hybrid particle-in-cell numerical model of the interaction of the Moon with external plasma environments to compute electric fields in the lunar environment for a variety of external plasma conditions and interplanetary magnetic field orientations. Ion dynamics were attained from the hybrid code while electron dynamics were determined by considering electron test particle trajectories through the fields established in the hybrid code. Results from the code will be presented to evaluate charging environments within the lunar wake.